COMPARISON OF A COMPUTER ASSISTED INSTRUCTIONAL UNIT AND A PROGRAMMED TEXT FORMAT FOR TEACHING LATIN AND GREEK DERIVATIVES TO CONDITIONALLY ENROLLED UNIVERSITY STUDENTS

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by

Janice Dursky

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An abstract of a Dissertation by
Janice Dursky
November 1983
Drake University
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The Problem. The purpose of this study was to compare a computer assisted instruction mode with a programmed text mode for teaching Latin and Greek derivatives to conditionally enrolled university students.

Procedures. The eighty three students of Drake University's fall 1982 Transitional Services Program were the subjects for this investigation. Students were randomly assigned to the two treatment groups. Treatment One learned Latin roots and prefixes by the programmed mode and the Greek portion of the unit by the computer mode. Treatment Two studied the Latin roots and prefixes by the computer mode and the Greek portion of the unit by the programmed mode. The content of instruction was identical for these two groups; they differed only in sequence of mode. Student characteristics relating to personality types and learning styles were examined in relationship to both achievement and attitude toward mode of instruction. Data was collected from six measurement instruments: the Slosson Intelligence Test, the Myers-Briggs Type Indicator, the Learning Styles Inventory, a semantic differential and Latin and Greek pre-posttests.

Findings. The data reveal no differences in achievement between the two treatments. Subjects using both CAI and PT did not achieve higher posttest scores in either mode. There was a significant difference beyond the .01 level in attitude toward CAI, favoring the CAI mode, but this did not result in significantly greater achievement. Analyzing differences in learning style and personality type did not reveal differences in either achievement or attitude.

Conclusions. The results of this research suggest that CAI is at least as effective as PT for teaching Latin and Greek derivatives. When both instructional modes are available, student attitude should be considered in planning learning strategies.

Recommendations. Further research should be conducted with these modes of instruction, specifically regarding the use of an audio component to enhance the learning strategies. The relationship between visual and audio media would provide additional information concerning the effectiveness of electronical devices. Additional investigation of personality types and learning styles is needed to examine how these student characteristics relate to learning.

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CHAPTER ONE

Introduction

Need

Educators have met with both frustration and determination in their efforts to provide for individualization of instruction. In a rapidly changing society, where technology is playing an increasingly important role, teachers have looked to technology for assistance in their struggle to meet individual needs. Does technology really offer optional instructional media which will contribute to the solution of problems met in attempting to individualize instruction?

If educators expand their interest in individualization to include the general goal of "adaptive education," as suggested by Harold Mitzel, then individualized instruction may offer the vehicle to achieve this aim. Adaptive education refers to designing of subject matter presentations to suit the requirements of each learner. No learner should be hindered from reaching his/her full potential in any curricular area because of differences in study and instructional strategies.[1] Close upon the dawning of the computer age, called

[1] Harold E. Mitzel, "On the Importance of Theory in Applying Technology to Education," Journal of Computer-based Information, 47, No.14 (May 1981), 93.

by some the "fourth revolution in human communications," the computer has found its way into education in the form of computer assisted instruction (CAI) and presents new opportunities for individualized instruction.[1] It offers a fascinating potential for learners to achieve skills required for coping in a changing world.

The use of computer programs has been suggested as a realistic and effective system of providing individualized instruction, which can free teachers to concentrate on concerns requiring professional judgments by relegating more routine tasks to the computer. Bork suggests that the computer may meet the challenge of promoting student interaction with the learning environment without casting the teacher into an authoritarian role.[2] By effectively guiding students into active participation in the learning process, computer assisted instruction may also offer the potential for higher achievement levels.

> If, by a miracle of mechanical ingenuity, a book could be so arranged that only to him who had done what was directed on page one would page two become visible, and so on, much that now requires personal instructing could be managed by print.[3]

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[1] Harold G. Shane, "The Silicon Age and Education," Phi Delta Kappan, 63, No. 5 (January 1982), 307.

[2] Alfred Bork, "Interactive Learning," in The Computer in the School, ed. Robert Taylor (New York: Columbia University, 1980), pp. 59-60.

[3] Edward Thorndike, Education (New York: Macmillan Co., 1912),p. 40.

This recommendation written in 1912 by Edward Thorndike suggested the possibility of programmed instruction and automation. Yet, the "miracle" he envisioned has not enjoyed widespread use or acceptance despite the fact of its availability in the form of programmed instruction and teaching machines.[1] While individualization has been a familiar topic of discussion our understanding remains unclear regarding what actually constitutes individual differences in learning.[2] Mitzel and Tobias claimed that few educators have effectively demonstrated individualization beyond the concept of self-pacing which allows learners to move through materials at a self-determined rate comfortable to them.[3] The present study examined individual differences in terms of certain learning style and personality characteristics as they relate to learning.

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[1] Edward Fry, How Effective is Programed Instruction in Teaching Reading (ERIC ED 026 219).

[2] Mitzel, p. 94; Robert M. Gagné, "Learning and Individual Differences: Introduction to the Conference," Learning and Individual Differences, ed. Robert M. Gagné (Columbus, Ohio: Charles E. Merrill Books, Inc., 1967), pp. xi-xv.

[3] Mitzel, p. 94; Sigmund Tobias, "Achievement Treatment Interactions," Review of Educational Research, 46, No. 1 (Winter 1976), 61.

Statement of the Problem

The purpose of this study was to compare the effectiveness of a computer assisted instructional format when compared to a programmed text format in teaching Latin and Greek derivatives to conditionally enrolled university students. The study sought answers to the following questions: Will the use of a computer assisted instructional format result in a difference in student achievement and attitude when compared to a programmed mode of identical content in terms of certain learning style and personality variables?

Achievement scores were analyzed to answer the following general questions:

1. How will performance scores in each instructional mode relate to selected personality characteristics?

2. How will performance scores in each instructional mode relate to preference for a mode of instruction?

3. How will performance scores using each mode of instruction relate to learning styles?

4. How well can a prediction be made of which instructional mode would be better suited to individual students?

Hypothesis

Two hypotheses were tested:

1. After controlling for intelligence, there will be no difference in achievement scores for students using the computer assisted instructional mode as compared to the programmed mode.

2. Attitude toward the computer assisted mode will be more positive than attitude toward the programmed mode.

Assumptions

1. It was assumed that any attitudinal difference demonstrated for the computer assisted instructional mode occurs because of a real and relatively permanent preference for this mode of instruction and not because of a temporary preference due to novelty.

2. It is assumed that the standardized tests selected for this study: The Slosson Intelligence Test, Learning Styles Inventory, and the Myers-Briggs Personality Indicator, are valid instruments for use with this population since college level students were included in the validation processes for each of the tests.

Limitations

1. Because the subjects used in this study are underprepared, conditionally enrolled university students, conclusions may not be validly generalized beyond this type of population.

2. The learning task, a vocabulary unit is limited to one hundred Greek and Latin roots and prefixes.

3. The vocabulary learning task used may not be representative of all possible types of verbal learning tasks required in this typical curriculum.

4. Instructional time did not extend beyond six weeks.

Definition of Terms

1. PROGRAMMED INSTRUCTION (PI)--any instructional materials incorporating the characteristics of small incremental steps, active responding, and immediate feedback on correctness of response.

2. PROGRAMMED TEXT (PT)--a text that incorporates the characteristics of programmed instruction.

3. COMPUTER ASSISTED INSTRUCTION (CAI)--an instructional method utilizing the computer as the primary means of presenting instructional material.

4. COMPUTER-BASED INSTRUCTION (CBI) or COMPUTER-BASED EDUCATION (CBE)--often synonymous with computer-assisted instruction, but sometimes refers to instruction that requires less direct student interaction with the computer in terms of presenting material.[1]

5. CONDITIONALLY ENROLLED--an enrollment classification that pertains to those students who have not met the standards of admission either because of high school grades or college entrance exam scores.

6. TRANSITIONAL STUDENT PROGRAM (TSP)--a program that gives students who do not meet admission requirements the opportunity to attempt college level study through a special program that includes a reading and study skills course designed to meet their special needs, and academic counseling.

Importance of the Study

There is ample evidence that people learn from media, yet very little evidence is available concerning which medium can promote the most learning in a given situation. Little research evidence exists to indicate which medium

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[1] Robert L. Burke, CAI Sourcebook (Englewood Cliffs, N.J.: Prentice-Hall.,1982), p. 188.

may have advantages over another for a particular kind of learner in accomplishing a specific learning task.[1]

While the idea of individualization stimulates interest, it has resulted in few successful systematic efforts to vary the method of instruction to correspond with such student characteristics as learning styles and personality types.[2]

In today's increasingly complex society where the goal of education is the realization of the student's human potential, educators need ways of assisting students in their development of self-directed inquiry and also of examining methods of providing adaptive education.

Mitzel suggests that more attention should be given to the learner as an individual so that such things as learning style or personality characteristics do not hinder the learner from reaching his/her fullest potential. Much of the scholarly concern for teaching has centered around two elements: the teacher and the materials of instruction. Educators' concern for the learner has been primarily one of getting the student to conform to instructor expectations, textbooks, and instructional time limitations. Mitzel recommends stressing

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[1] Wilbur Schramm, Big Media Little Media (Beverly Hills, Calif.: Sage Publications, 1977), p. 43.

[2] Tobias, p. 61.

that uniqueness each learner brings to the instructional environment.[1] Adaptation to individual or group differences, whether considering alternative schools, computer-based education or several other possibilities, is the focus of educational reform themes.[2] The basic premise, that people vary both in aptitude and other characteristics, tends to validate the importance of greater variety in learning strategies.[3] The college classroom should not be excluded from this focus on the need for individualized instruction. College instructors are often amazed at the diversity of their student clientele in terms of talent, preparation, and maturation, yet, according to Maxwell, this diversity in student population will probably continue to grow as institutions of higher education face declining enrollments and student retention problems.[4]

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[1] Harold E. Mitzel, "Computers and Adaptive Education," American Education, 6, No. 10 (December 1970), 23-24.

[2] Lee J. Cronback and Richard E. Snow, Aptitudes and Instructional Methods (New York: Irvington Publishers, Inc., 1977), p. 491.

[3] Carol A. Carrier, "The Role of Learner Characteristics in Computer Based Instruction," National Society for Performance and Instruction, 18 (June 1979), 25.

[4] Martha Maxwell, Improving Student Learning Skills (San Francisco: Jossey-Bass Publishers, 1980), p. 24.

Knowles has emphasized a similar attention to the uniqueness of student characteristics, suggesting, that in the future educators will be responsible for linking autonomous learners with more appropriate learning resources. Students should not leave the formal schooling environment until they have demonstrated mastery of the skills necessary for autonomous learning. At present, many college students acquire only the skills of learning by being taught, not those required for autonomous learning.[1]

Hansen stated that much of the research concerning computer assisted instruction has been done by comparing it to traditional methods of teaching, and although computer assisted instruction has been found to be effective, more research is needed.[2] Dence recommended further research into cognitive style and personality types to help determine CAI strengths in the role of individualization and its valid use in specific educational settings.[3]

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[1] Malcolm S. Knowles, "Preface," Developing Student Autonomy in Learning, ed. David Boud (New York: Nichols Publishing Co., 1981), p. 8.

[2] Duncan N. Hansen, Current Research Development in Computer Assisted Instruction (ERIC ED 038 863).

[3] Marie Dence, "Toward Defining the Role of CAI: A Review, " Educational Technology, 20, No. 11 (November 1980), 54.

Purpose of the Study

This study was concerned with analyzing the relationship between certain student characteristics and achievement through the employment of two instructional modes. The students comprising the Transitional Student Program at Drake University were selected as the population for this research.

One characteristic often exhibited by these students is an apparent reluctance to become self-involved in the learning process. Computer assisted instruction was chosen as one instructional mode because it demands an active role from the learner. It was thought that an analysis of student reaction to both CAI and PT might help determine the role of these two instructional modes in this setting.

The results of this investigation of student characteristics, should be useful in short term instructional planning. Since both modes, CAI and PI, are currently accessible to the TSP program, if both effectively produce learning, more innovative ways to use them could be considered. If one mode seems more appropriate for some students, then matching student with instructional mode will facilitate adaptive education and merit further research of student characteristics.

CHAPTER TWO

Review of Related Literature

Introduction

The purpose of this review of literature is to provide an overview of the theories supporting this investigation and to highlight the research relevant to different aspects of the study. In this review, literature is presented in two categories: 1) research that describes computer assisted and programmed instruction as it relates to reading, and 2) research that incorporates such characteristics as attitude toward instructional mode, as they relate to learning style and personality characteristics. These two parts of Chapter Two are preceded by a theoretical overview of two theories that have influenced computer assisted instruction and programmed learning.

Theoretical Overview

This overview of the theories supporting the present investigation includes a discussion of the function of education as well as the perspective role of individualization in adaptive education. It also contains information concerning two theoretical approaches that have influenced educational technology-behaviorism and cognitive learning theory.

Computer technology has advanced to the point where the main question is not, "What can the computer do?" but "What role do we as educators want the computer to play?" The answer to this question does not lie in the mechanical circuitry of the machine, but in the professional expertise of educators and their willingness to rethink and perhaps redefine their function in the learning process.

One requirement of education is the presentation of information, and though this function is limited, it seems to be the area in which instructors concentrate much of their efforts. This presentation function may be one that could be supplied better by print, or a technological tool, than by the teacher in person.

Patricia Cross argues that teachers' attention must be shifted from this limited role of providing information. "If teachers continue to define their role narrowly as classroom disseminators of information, then it is likely that in the not very distant future, they will be replaced by machines because they can be."[1] She, therefore, suggests that teachers make more effective use of technology and new developments in instructional design. In reference to these developments she feels student activity should be maximized to create the opportunities for learning to take place.

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[1] K. Patricia Cross, The New Frontier in Higher Education: Pioneers for Survival (ERIC ED 179 140).

According to Cross multimedia materials, which are self-pacing, self-evaluating, and presented by technical means, should be used to present subject matter, saving class time for meaningful interaction between teacher and students, and between the students themselves.[1]

Malcolm Knowles expresses the need for teachers in higher education to redefine their role. To assist students in developing higher level problem-solving skills demanded now, and in the future, there is an urgent need for programs of higher education to concentrate on promoting autonomous learning and initiating self-directed learning activities. This will demand a new teaching emphasis centering upon the acquisition of content instead of the presentation of content.[2]

Mitzel examined the concepts of individualization in reference to present educational practice and maintains that there is little evidence that these concepts have been successfully implemented in the typical classroom. He identifies five concepts and suggests that the pursuit of adaptive education will depend upon emphasizing the role of individualization beyond its current status.[3]

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[1] Ibid.

[2] Knowles, p. 8.

[3] Mitzel, "On the Importance of Theory in Applying Technology of Education," p. 94.

The first concept entails self-paced instruction which means allowing the student to work through the material at a comfortable rate. While this is somewhat easier to control with reading materials, it is harder to accomplish when content is presented using lectures, films, or television. The second concept provides that students should be able to work during times convenient to them. This is frustrated in many educational settings by school management procedures such as credits, schedules and grades. The third concept proposes that the learner should begin instruction at a point determined by his past goal. The underlying assumption associated with this concept is that progress is linear and depends upon beginning at the proper point. The fourth concept suggests that the learner may be inhibited by a few easily identifiable skill deficits. It is assumed that special instructional procedures may eliminate such problems. This idea will definitely be tested as colleges accept more students having these kinds of difficulties. The fifth concept involves giving learners a variety of instructional options and a broader choice of learning materials. Research, however, does not support the idea that student choice alone results in optimal learning.[1]

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[1] Ibid.

Mitzel claims that individualization has not progressed much beyond the first concept, and furthermore, these principles alone are not sufficient to achieve adaptive education. Computer-based education may offer the potential for bringing adaptive education into reality by providing a tool that has the capacity to measure individual differences and to give good feedback.[1]

Behaviorism

Although computer-based education has moved beyond behaviorism, its beginnings are found there. The behaviorism of B.F. Skinner emphasizes consideration of the student's behavior rather than the various uses of computer hardware.[2]

Though Skinner played a major role in the development of instructional technology, he does not deny that students can learn in a natural environment without such specialized technological assistance. He does maintain that they may be assisted by teachers who provide systematic reinforcement for gradual changes in behavior. He concludes, from experimental evidence, that students are more likely to produce correct responses if they begin with relatively easy tasks and progress gradually to more difficult items. This requires

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[1] Ibid.

[2] B.F. Skinner, "Some Prior Considerations," Phi Delta Kappan, 58, No. 6 (February 1977), 456.

highly reliable presentation of sequential materials as well as consistent reinforcement for each satisfactory response. Skinner recommends a programmed instruction format, or a teaching machine, to insure these optimal conditions. The term "program" is used to designate those educational materials that have been specially prepared in small sequential steps of increasing complexity and "teaching machine" refers to any device that provides feedback as the learner progresses through the presentation of materials.[1]

Skinner describes the effect of teaching machines upon the student as similar to that of a private tutor. He suggests that five qualities are associated with teaching machines: they, 1) promote sustained activity between the program and the student, 2) do not move on until understanding is achieved, 3) present only the information for which the student is ready, 4) prompt the student when necessary, and 5) provide reinforcement for correct responses.[2]

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[1] Glenn E. Snelbecker, Learning Theory, Instructional Theory and Psychoeducational Design (New York: McGraw-Hill Book Co., 1974), pp. 390-91.

[2] William A. Deterline, An Introduction to Programed Instruction (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1962), pp. 12-13.

It is just these elements that form the framework of programming principles. 1) Educational material is presented through small units called frames which usually consist of several sentences or short paragraphs. 2) A response is required from the student. 3) The student is given immediate feedback to reinforce a correct response or to correct a misunderstanding. 4) Careful sequencing of material allows for gradual shaping or leading the student to closer approximations of the goal. 5) Goals are specific. 6) Student responses identify weaknesses in the program so that revision can be made. 7) Students may generally control their rate of learning.[1]

The basic difference in CAI and PI centers on the difference in media. Even though both involve the printed word, CAI promotes an active dialogue between machine and student, whereas PI is basically unresponsive to student behavior.[2]

In 1964, Wilbur Schramm wrote that, although programmed instruction had the potential to be used to focus attention on testing various theories of human learning and cognitive

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[1] Edward B. Fry, Teaching Machines and Programmed Instruction an Introduction (New York: McGraw-Hill Book Co., Inc., 1963), pp. 2-3.

[2] Allan N. Blitz and Timothy Smith, Personality Characteristics and Performance on Computer Assisted Instruction and Programmed Text (ERIC ED 074 750).

processes, it had not been widely used in this manner. He recommended that other teaching mediums such as television and films be examined and modified to incorporate some of these principles.[1] One teaching medium that has incorporated programming principles is computer assisted instruction. The theoretical roots of this form of educational technology come from cognitive psychology.[2]

Cognitive Psychology

Cognitive learning theories developed from the work of such psychologists as Edward C. Tolman, Kurt Lewin, Max Wertheimer and Wolfgang Kohler. Proponents of this theory do not deny that behavior change may result from associative or conditioned learning. They do not feel, however, that stimulus-response principles entirely explain complex problem-solving behavior. They maintain that learners react to cognition, beliefs, attitudes and goals instead of focusing upon stimuli. "Insight" is a major factor in learning and refers to "the sudden re-organization of the field of experience, such as the

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[1] Wilbur Schramm, Four Case Studies of Programmed Instruction (New York City: Fund for the Advancement of Education, 1964), pp. 114-150.

[2] Mitzel, "On the Importance of Theory in Applying Technology of Education," p. 96.

acquisition of a new idea or the discovery of a solution."[1]

Cognitive psychologists have demonstrated that complex problems may be solved by animals and humans by thinking, observation, and discovering the relationships of elements constituting the problem. Their critics contend, however, that part of this behavior develops through trial and error, as well as reinforcement. The individual's past experience seems to highly influence the development of insight and such insight is not involved in all learning.[2]

Ausubel maintained that this theory describes the human nervous system as a data-processing and storing mechanism which collects and retains only new information that relates to already available propositions and concepts.[3]

It is possible that some types of learning may involve both theories. Some theorists have suggested that a technology of teaching depends upon careful scrutiny of the roots of both behaviorism and cognitive learning theories. Gagne' addressed two key questions in this spirit: 2) What is the prospective role of the computer in instructional

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[1] Paz I. Bartolome, Learning Theory (Morristown, N.J.: General Learning Press, 1976), p. 12.

[2] Ibid., p. 15.

[3] David P. Ausubel, Learning Theory and Classroom Practice (Toronto, Ontario: The Ontario Institute for Studies in Education, 1967), p. 10.

technology? He argues that the cognitive approach has incorporated some of the important elements of behaviorism, namely that of reinforcement and learning objectives. Determining objectives, or clearly defining learning goals, provides a basis for instructional design. Reinforcement for the cognitive psychologist, however, emphasizes expectancy. When reinforcement occurs, according to cognitive psychologists, an expectancy has been confirmed by the learner. This confirmation is associated with the objective, because, as the learner becomes informed, expectancy is being established. The instructional designer influenced by cognitive learning theory will give careful attention to the organization of material that is presented to the learner in order to develop expectancy.[1]

Although Gagne' claims that the computer may be used in a variety of ways within the educational setting, he emphasizes its use for drill and practice. He suggests that educators should not overlook the value of this instructional technique because it can serve an important function in the student's learning process. When the

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[1] "An Interview with Robert M. Gagnè, Developments in Learning Psychology Implications for Instructional Design; and Effects of Computer Technology on Instructional Design and Development," Educational Technology, 22, No.6 (June 1982), 12.

learner undertakes the problem-solving required in reading, writing, or mathematics, effective processing is increased if some of the subordinate skills become automatic. A tireless tool, the computer may provide repetitive drill exercises giving the student a greater opportunity to make these skills automatic.[1] Landa has described automatization this way:

> Automatization is nothing other than the process of gradual exclusion of instruction and self-instructions as factors actuating and guiding manual and cognitive operations, and the transition to a psychological state when these operations can be actuated and guided by external objects (through their internal representations in the form of images and concepts) and by other operations.[2]

Mitzel states that there are four theoretical considerations to be met if computer-based education is to provide the key link to adaptive education. The first requirement calls for measuring individual differences among learners in more than simple stimulus-response situations or in studies of variables that treat human subjects as if they were all alike. To be most helpful research should be made of meaningful learning situations that clearly acknowledge

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[1] Ibid., p. 14.

[2] "An Interview with Lev. N. Landa, The Improvement of Instruction, Learning and Performance, Part One," Educational Technology, 22, No. 10 (October 1982), 9.

individual differences.[1] If educators seek to adapt programs to meet learners' needs, then they must become aware of exactly what these needs are.

The second requirement is a responsive learning environment. Using the computer in a tutorial fashion calls for rearranging the priorities of teacher behavior from an emphasis on subject-matter presentation to higher level behaviors that facilitate a responsive environment. In the conventional classroom,

> the aggressive, able child may recite as much as five times during a class period, while the shy, non-competitive ones may recite once a week or once a month...Children seated at computer terminals are busily solving problems and receiving evaluative information of a non-ego-threatening type every thirty to forty seconds.[2]

With a machine equipped to tirelessly present subject matter, provide assistance, and give feedback, the teacher may use time more valuably by interacting with students, by attending to the human side of learning, a requirement that the machine cannot fulfill.

The third consideration involves criterion-referenced examinations and evaluating students in terms of mastery learning. Educators have conventionally given achievement tests at the end of a course of instruction to measure how

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[1] Mitzel, pp. 95-96.

[2] Ibid.

much instructional material was retained by how many students. Grades were assigned on how well the individual student compared with the group, not how much gain the individual achieved. These tests have sometimes been constructed on the premise that half the tests questions should produce incorrect answers for half the students.[1] The expectation of failure is, at least, suggested by this manner of testing. Criterion-referenced examinations are based on the clear statement of intended learning outcomes or mastery, and focus on success, not failure.

The fourth consideration associated with cognitive psychology is the influence of recent research into long and short term memory, brain function, and field dominance needs to be represented in instructional design and planning.[2]

In order to actually become an effective instructional vehicle supporting adaptive education, computer-based techniques will need a sound framework based on these considerations.

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[1] Ibid.

[2] Ibid.

CAI PI and Reading

The studies cited in this review of literature involving computer assisted instruction in the teaching of reading have been limited to those in which subjects were either adult age or college level students. Two of these studies involve CAI and four compare CAI with programmed instruction. Since the basic difference between CAI and PI centers on the difference in media, a comparison of the two should show whether any differences exist between these modes of instruction. These studies have been preceded by a discussion of a meta-analysis that investigated the impact of CAI on college students as well as their reactions to the experience.

James and Chen-Lin Kulik and Peter Cohen make a meta-analysis primarily to provide a synthesis of the large volume of research findings investigating computer-based education at the college level. The synthesis was based upon 59 studies classified in these five categories: course completion, instructional time, student achievement, correlation between achievement and aptitude, and student attitudes. According to this study, computer use in college classrooms has made a small but significant contribution to instruction.[1]

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[1]James A. Kulik, Chen-Lin C. Kulik, and Peter A. Cohen, "Effectiveness of Computer-based College Teaching: A Meta-analysis of Findings," Review of Education Research, 50, No. 4 (Winter 1980), 527.

The research suggests that in a typical situation involving examination achievement, an average student taught by conventional methods would score at the 50th percentile, while an average student taught by a computer-based system scored at the 60th percentile. High, average, and low aptitude students showed similar correlations (.50) between aptitude and achievement, demonstrating that the difference in achievement shown by students taught by these two methods cannot be attributed to aptitude. Positive attitudes toward instruction and subject matter were exhibited by students using the computer. They seemed to like the course more and show more interest when instruction included the computer.[1]

Caldwell and Rizza evaluated a computer-based system of teaching reading to adult non-readers from eight demonstration projects conducted at public school, correctional institutions, and adult basic education centers in Maryland, Minnesota and Texas. They used a modularized network, the Basic Skills Learning System which includes tests, printed materials, computer assisted tutorials, drills and videotaped presentations aimed at improving basic reading skills of adults whose skills fall between the third and eighth grade levels. After less than twelve hours of instruction, these learners showed an average gain of one year in reading.

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[1] Ibid., p. 538.

Dropout rates which can be as high as fifty percent in some programs, were reduced to less than five percent.[1]

This Plato system, as the modularized network is known, together with the multi-media support activities, helped illiterate adults improve basic reading skills in several ways. The individualized curriculum assessed each learner's needs and adjusted rate of progress on the basis of responses and provided more opportunities for feedback than the traditional classroom setting. Mastery learning promoted success and created self confidence. Modularized organization permitted adaptation to various learning situations.[2]

Multiple learning options were presented to students at the learning lab of the University of Hawaii-Hilo/Hawaii Community College. For those whose preferred instructional mode included listening, reading or visual presentation, the PLATO system was one available option. For those whose instructional mode was person dependent, other options providing opportunities for personal interaction were utilized. Over 300 reading and math students used the PLATO (Programmed Logic for Automatic Teaching Operations) basic skills program

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[1] Robert M. Caldwell and Peter J. Rizza, "A Computer-Based System of Reading Instruction for Adult Non-Readers," Association for Educational Data Systems, 12 (Summer 1979), 155.

[2] Ibid.,p. 162.

in a given semester. Control and experimental groups were designated as Non-PLATO (no computer use) and PLATO (four hours usage minimum). This study, conducted over two semesters, Spring 1980 and Fall 1980, intended to measure the impact of PLATO on attitudes toward learning rather than to emphasize achievement. These high risk students expressed a positive reaction toward PLATO. Rates of course completion increased by 28% and those of student persistance from one semester to another improved by 10%. Over 80% of the students using PLATO reported an increase in reading interest. Possible explanations for these positive attitudes were associated with these three functions of the CAI system: 1) positive reinforcement, 2) patience, and 3) repetitive nature of lessons and explanations.[1]

Caldwell's dissertation at Penn State University compared a programmed text with a computer assisted instructional unit of identical content for teaching reading to semi-literate adolescents from Centre County, Pennsylvania. Subjects, drawn from five high schools, ranged in age from 14 to 18. All read below the fifth grade level. Data was

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[1] John Penisten, The Effects of Computer Assisted Instruction in a Community College Learning Lab (ERIC ED 202 503).

collected on 18 students composing the CAI group; and 38 subjects comprising the PI group.[1]

Reading achievement was measured through the use of criterion-referenced measures yielding pretest and posttest scores. Analysis of this data revealed that subjects did not differ significantly on either test. Therefore, neither mode of instruction could be credited with producing a greater effect than the other. Significant differences were found between the pretest and posttest for each group indicating that both modes were successful in influencing achievement. Attitude toward instructional mode was measured by a semantic differential. Students expressed a significant positive attitude toward the CAI mode at the .05 level in comparison with the programmed text.[2]

Mull's dissertation, also at Penn State compared CAI with a programmed Workbook (PW) for effectiveness in teaching inservice teachers the Initial Teaching Alphabet (ITA), to transliterate the ITA characters to the traditional alphabet (TO), as well as to transliterate TO to ITA characters. Subjects were drawn from three graduate reading courses at the University and randomly placed into two treatment groups.

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[1] Robert McKinley Caldwell, "A Comparison of a Programmed Text and a Computer-Based Display Unit to Teach Reading Skills to Semi-Literate Adolescents." Diss. Pennsylvania State Univ., 1973, pp. 44-45.

[2] Ibid., pp. 75-76.

Treatment I comprised those teachers who were instructed using the CAI medium, while treatment II subjects used the Programmed Workbook (PW). Three criterion-referenced pre-tests and posttests were administered in this study as well as two attitudinal scales-attitude toward Computer Assisted Instruction and attitude toward ITA as a Medium for Teaching Reading.[1]

Treatment I (PW) seemed to achieve more positive effects in teaching the Initial Teaching Alphabet to these inservice teachers than Treatment II (CAI). No differences were found, however, in either program in relation to trans-literation.[2]

Use of the CAI program by Treatment II resulted in a significant positive attitude toward computer assisted instruction, but not in a positive increase in attitude toward ITA. Treatment II (PW) showed a significantly positive attitude toward the Initial Teaching Alphabet. One explanation for this is that the CAI group was faced with two unfamiliar tasks, that of working at the computer

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[1] Patricia Ann Mull, "A Comparison of Computer Assisted Instruction and a Programmed Workbook to Teach the Initial Teaching Alphabet and Transliteration to Inservice Teachers," Diss. Pennsylvania State Univ., 1973, pp. 65-66.

[2] Ibid., p. 68.

terminal and learning the ITA program.[1] Bossone conducted a study at Baruch College, New York, utilizing three instructional methods to teach basic writing and reading skills to remedial English students. The 167 students were divided into two groups, those needing more intense remediation and those needing less intense instruction. Eight classes were taught by CAI, four classes involved using PI and one class was given regular classroom instruction, specifically using a linguistic approach. The content differed greatly among these three modes of instruction. The linguistic mode emphasized sentence structure and paragraph organization, while the PI and CAI modes emphasized basic English grammar and usage. There is no indication of how closely the content of the Programmed text corresponded to that of the CAI. CAI was at least as effective as the other modes of instruction.[2]

Golub investigated the effectiveness of CAI and PI in a literary development program designed to teach reading skills to youth ranging in age from 14 to 24. Complete

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[1] Ibid., p. 71.

[2] R.M. Bossone and M. Weiner, Three Modes of Teaching Remedial English: A Comparative Analyses: A Pilot Study (ERIC ED 074 514).

data was collected for 23 students. While gains in reading achievement occurred, they were not statistically significant. Two possible explanations are offered for this. First, this study represented only 8-10 hours of instruction. Second, a norm-referenced achievement test was used to evaluate that did not specifically pertain to these learning tasks. When the effects of this program were measured by a 31 item criterion-referenced test the result was a significant gain at the .05 level. Posttreatment attitude measures showed that students had positive attitudes toward the CAI presentation as well as for the programmed presentation. These students expressed a significantly higher attitude toward the CAI mode at the .05 level than for the programmed text.[1]

In summary, the two studies involving CAI in the reading curriculum reported positive findings. The researchers attributed CAI with greater course completion rates, student persistance, and gains in reading achievement and interest. When CAI was compared to PI in reading instruction, the two investigations that controlled for identical content reported

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[1] Lester S. Golub, A Computer Assisted Literacy Development Program for Career Oriented Youth and Adults, Ages 14 - 24 (ERIC ED 088 094).

findings which indicated that CAI was at least as effective as programmed instruction in promoting learning. Less clear indications of the effect of CAI as compared to PI can be made in the other two investigations because one contained differences in the content and the other did not use test questions that related to the specific learning tasks that students were expected to learn.

CAI and Student Characteristics

The studies included in this part of the review of literature pertain to the relation between student characteristics and CAI. Assessment of attitude toward the learning experience plays an important part in these investigations as it has done in the other studies relating CAI and PI to reading. In an attempt to focus upon individual differences, these studies incorporate other assessments such as personality and learning style variables.

Magidson questioned the positive student ratings of CAI in studies involving a small number of students whose interaction with computer instruction had been limited. His investigation involved the Plato system (Programmed Logic for Automatic Teaching Operations) developed at the University of Illinois. This system allows teachers to supplement regular

classroom instruction with individualized, self-paced PLATO instruction which fulfills the purpose of tutor, test, or text. In 1976 he selected one of the city colleges in Chicago, Kennedy-King College, to study student attitudes toward PLATO. Sustaining an active CAI program since 1973, this college utilized PLATO in about 70 classes with over 2000 students who averaged seven hours each in interaction with the system. This study solicited feedback concerning student attitudes toward CAI. By responding to survey questions, students indicated attitudes toward specific features of CAI, such as self-pacing, mechanical aspects involving operating the terminal and toward the lessons. Comparisons were made between the attitudes of first semester users and those who had used CAI in a previous semester.[1]

The survey contained twenty forced-choice questions (agree or disagree) and two questions asking that the students write what they liked and disliked about PLATO. In addition, students were asked to indicate whether they had used this system before the fall term of 1976.

First time users assessed the system in a very positive manner: 1) they felt it was useful as a learning aid,

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[1] Errol M. Magidson, "Student Assessment of PLATO: What Students Like and Dislike About CAI," Educational Technology, 8, No. 8 (August 1978), 15.

2) they enjoyed using it and did not feel it was dehumanizing, 3) they worked with PLATO during some of their leisure hours and 4) they experienced only minor operating difficulties, but they did indicate that breakdowns of computer terminals caused some hindrance. About 40 percent of these students who had used PLATO before the fall gave the system a slightly less positive rating.[1]

Magidson offered these implications and recommendations for CAI programs: 1) When CAI programs incorporate the characteristics for which CAI was intended, students will rate the CAI experience in a very positive manner. The presence of any novelty effect does not noticeably disintegrate for long-term users, but they do become more aware of potential problems. 2) Prior to computer use students should be familiarized through a demonstration with some of the operating problems and possible frustrations. 3) CAI lessons should fit into the student's curriculum.[2]

The results of a three-month PLATO trial at Mercer University yielded positive student ratings. Of 76 students participating 95.9 percent indicated that they 1) would recommend PLATO to their friends, 2) would use the program

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[1] Ibid., p. 18.

[2] Ibid., p. 19.

again and 3) thought the experience was beneficial.[1]

Hoffman and Waters compared the effects of student personality on success with CAI in a study of 155 military students at the Naval Technical Training Center, Pensacola, Florida. Their training involved learning and transcription of the Morse code. This investigation utilized the Myers-Briggs Type Indicator (MBTI) for assessing personality characteristics. Based upon Jungian typology it offers four dichotomous indices: extraversion-introversion (E-I), sensing-intuition (S-N), thinking-feeling (T-F), and judging-perceptive (J-P). The researchers posed two questions in this study: 1) Did some personality types finish the CAI more quickly than others? 2) Does a relationship exist between personality type and dropout rate?[2]

Some significant differences were found. The sensing types seemed to complete the CAI program more quickly than the intuitive (N) types (significant at the .01 level). Among the ENPs (Extravert, Intuitive, and Perceiving) a higher than expected dropout rate occurred. The highest rate occurred with the EPs (Extravert, Perceptive) attrition.

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[1] Tracie M. Jenkin and Elizabeth J. Dankert, "Results of a Three-Month PLATO Trial in Terms of Utilization and Student Attitudes," Educational Technology, 21, No. 3 (March 1981), 44-45.

[2] Jeffrey L. Hoffman and Keith Waters, "Some Effects of Student Personality on Success with Computer-Assisted Instruction," Educational Technology, 22, No. 3 (March 1982), 20.

Of the original 38 EPs, 53 percent dropped out, a figure that represents 38 percent of all dropouts.

There are some possible explanations for these results. Sensing-type personalities have been described as being able to attend to detail, quietly concentrate, and remain on task until completion. Extraverted Intuitives (ENs) have been attributed with these characteristics, preferring theory rather than application, liking variety and action, and being more interested in a broad picture instead of details. The perceiving type, characterized by flexibility, is not particularly observant of time or planning, and is frequently not dedicated to remaining on task. Of these characteristics, only those associated with the sensing type personality would be expected to support the demands of CAI.[1]

The sample for a dissertation study done by Patricia J. Mravetz was drawn from a rural junior high in the Akron area and consisted of thirty students from grades 7 and 8. All students were evaluated by the California Achievement Tests in Reading and found to be one or more years below reading grade level. Twenty students were randomly selected for the experimental group (CAI), and those students placed in the control group (Non-CAI) were taught by a reading teacher. In addition to the achievement tests the following attitudinal scales were administered: 1) the Crandall Intellectual

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[1] Ibid., pp. 20-21.

Achievement Responsibility Scale, 2) the Sears Self Concept Scale, 3) the Coopersmith Esteem Inventory.[1]

Change in reading achievement was significant at the .05 level which suggests that CAI may have had a positive effect. While not statistically significant, substantial change in self concept was evidenced by the Sears Self Concept Scale. The experiemental group (CAI) experienced a greater increase than the control group. It appeared that one possible explanation for the lack of significance was the great difference in self concept level. At the start of the treatment period, the Coopersmith analysis showed that the self concept of those in the experimental group increased 3 times as much as it did for those in the control group. A change in internal locus of control was found to be significant at the .05 level. The experimental group experienced an increase in internal locus of control; while the control group appeared to move toward external control.

These findings suggest that basic skills achievement can be obtained through CAI based upon increases in all variables from pretest to posttest in the experimental group. Statistically significant differences were found in locus of control characteristics. Students in the experimental group,

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[1] Patricia J. Mravetz, "The Effects of Computer-Assisted Instruction on Student Self Concept, Locus of Control, Level of Aspiration, and Reading Achievement," Diss. Univ. of Akron., 1980, Abstract.

according to level of aspiration scores, were able to more realistically predict their achievement scores at the end of the study.[1]

Kenneth Henderson, Jr. compared individual characteristics and achievement of pre-service elementary teachers using a computer lesson for diagnosis of error patterns. The 40 subjects who completed the study were enrolled in an elementary mathematics methods course at the University of Florida. This study attempted to identify characteristics of the subjects that related to achievement in diagnosing error patterns in addition and subtraction.

Conceptual tempo, the subject's tendency to be either impulsive or reflective, was determined from the Matching Familiar Figures Test. Impulsive students tended to be fast and inaccurate, while reflective persons tended to be slow and accurate. The strategy the subject used to determine error patterns was not found to be significant. Conceptual tempo was found to be statistically significant at the .05 level. Reflective persons scored significantly higher than impulsive persons.

An important implication comes from this study for the teacher who wishes to include CAI in the classroom. Because

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[1] Ibid.

students differ individually and some educational strategies will be more successful with some students but not all, identification of such characteristics as conceptual tempo could be a good predictor of success in matching student with educational strategy.[1]

In two of these investigations references are made to "aptitude treatment interaction" and "trait treatment interaction." These two terms are used interchangably by educators and researchers, but merit some explanation. Cronback defined aptitude as "a complex of personal characteristics that accounts for an individual's end state after a particular educational treatment., i.e., that determines what he learns, how much he learns, or how rapidly he learns." [2]

It includes whatever may assist a student's survival in a specific learning environment. This could be affected by cognitive styles and personality characteristics just as much as the abilities measured by conventional tests.[3]

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[1] Kenneth D. Henderson, Jr., "Individual Characteristics and Achievement of Pre-service Elementary Teachers on a Computer Lesson on Diagnosis of Error Pattern," Diss. Univ. of Florida., 1981, p. 67-71.

[2] Lee J. Cronback, "How can Instruction be Adapted to Individual Differences?" in Learning and Individual Differences, ed. Robert M. Gagne (Columbus, Ohio: Charles E. Merrill Books, Inc., 1967), p. 23.

[3] Ibid., p. 24.

An interaction exists when a situation affects one kind of person in a particular way, but has a different effect upon another individual.[1]

Blitz and Smith conducted a study comparing personality characteristics and performance on computer assisted instruction and programmed text with 50 third year College of dentistry students at the University of Kentucky. Two sections of an oral pathology course were utilized. Group A consisted of 25 high-low GPA students who completed the first part of the course by CAI and the second part by PT. Group B consisted of 26 high-low GPA students who completed the first part of oral pathology by PT and the last portion by CAI. Performance results indicated that 25 students scored higher on the portion of the course they completed using CAI and 26 scored higher on the part they completed on PT.[2]

A student's preference for a mode of instruction did not necessarily result in higher performance. Comparing their preference to final exam scores, indicated that 12 of the 50 students were incorrect in determining which mode produced the most learning for them. Aptitude treatment interaction effects were found for five personality variables of the Edwards Personal Preference Schedule but there was no relationship between preference for CAI or PT and a student's

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[1] Cronback and Snow, p. 3.

[2] Blitz and Smith.

personality. While preference for CAI or PT was not critical in determining ATI effects, the extent to which these modes supported learning style by fulfilling personality needs was crucial in how all the students learned.

Orderly students could not only follow directions but could produce order in less structured material, while disorderly students, though they disliked instruction demanding order, needed it to learn material. Likewise, aggressive students may have indicated a preference for PT, but performed better with CAI possibly because it aroused their agitation.

> The key to predicting whether a student will learn more from CAI or PT is not his academic aptitudes, but more likely his preferences and attitudes, which are more a function of understanding the dynamics of the specific learning environment in conjunction with the individual's learning style and which are largely influenced by his personality characteristics. With this information, investigators cannot only predict learning, but construct learning environments to suit the individual student.[1]

The results of this study complement McCann's statements concerning the role of learning characteristics in adaptive computer based instruction (CBI) programs. He cited as their major benefit the accentuation of student strengths and the minimization of weaknesses.[2]

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[1] Ibid.

[2] Patrick H. McCann, "Learning Strategies and Computer-Based Instruction," Computers and Education, 5 (1981), 139.

Results of a study done by Kevin and Liberty, involving 63 students enrolled in an introductory chemistry course, indicated trait-treatment interaction. This course required a weekly lab session and two lectures, and instead of a third lecture, students used computer-based instructional modules. The (ORI)Bass Orientation Inventory was used in an attempt to measure the types of rewards individual students preferred and the Learning Styles Inventory (LSI) was included to assess the characteristics of various learning styles as they relate to success in the course.[1]

Three scales of the ORI were administered: 1) self-orientation, 2) interactive orientation, 3) task orientation. The first scale indicates how much direct personal reward an individual expects for his efforts. The second scale, interactive, assesses the importance of interpersonal relationships and task orientation indicates to what degree a person is determined to complete a task or deal with a problem. It was expected that high task scorers would perform well in computer-based educational situations.

The LSI determines four learning styles: AE (Abstract Experimentation) RO (Reflective Observation), AC (Abstract

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[1] Richard C. Kevin and Paul G. Liberty, Jr., Student's Personality, Attitude, and Learning Style as Predictors of Performance in an Undergraduate Organic Chemistry Course Using Computer-Based Education (ERIC ED 115 209).

Conceptualization) and CE (Concrete Experimentation). It was expected that high AE scorers might perform better with computer-based instruction than RO scorers because the computer allows more trials and alternatives than most conventional classroom techniques.

The computer group as compared to the regular instruction group scored higher on the ORI task scale and lower on the interactive scale. The computer group scored higher on the CE scale and lower on the AE scale, which could indicate they favor a non-analytic approach, while the regular group preferred a doing-oriented, practical approach.

Other results supported the hypotheses that computer based education (CBE) students are motivated more by task and are less concerned with interpersonal relationships than those taught in the regular classroom situation. Within the computer group high-task scorers achieved a higher mean grade than low-task scorers. Whereas in Group R (regular instruction) low-task scorers performed better. Group C students who had high interaction scores received poorer grades than those scoring low on the interaction scale and in Group R high interaction scorers performed better than low interaction scorers.[1]

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[1] Ibid.

This study seems to confirm the statement made by Carrier:

> Heavy doses of computer based instruction may be inappropriate for individuals whose rewards come from interacting with other people in discussion, joint problem solving activities or one-to-one tutoring situations. On the other hand, highly motivated individuals may find the opportunity to work independently and at their own pace highly gratifying, especially when the instruction is appropriately challenging.[1]

Tobias maintained that prior knowledge and achievement may affect student success with CBE. Students with a high degree of prior knowledge in a subject may not need much instructional support which may indicate a forward-branching sequence in computer instructional design. Students who are far less familiar with the subject or instructional task may need maximum support.[2]

These findings support trait-treatment interaction but there are two factors that confound the issue. Course grades did not depend totally upon computer-based instruction. Other conventional factors contributed heavily to the grade, i.e. tests over the text. Statistically significant differences on psychological measures could not be obtained because of the lack of students available for testing.[3]

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[1] Carrier, p. 22.

[2] Tobias, p. 72.

[3] Kevin and Liberty.

Summary

As technological growth has touched more aspects of our lives, it has not ignored the educational environment, nor have educators ignored its existence. As more and more educators try to bring the philosophy of adaptive education into a focused reality, professional interest is being sparked by curiosity as to what role the computer might or can play in the process of education.

Because of this educators have begun to re-examine the teacher's function. Consideration of a new teaching tool should parallel this definition of the teacher's task and role in the classroom. The authors cited in this review suggest that attention should be given to new developments in instructional design and to the promotion of autonomous learning. It has also been suggested that while our pursuit of individualization in the past has not been especially fruitful, a new basis of attending to individual needs may prove more fruitful. The emergence of a scientific system like computer-based education might give an effective form to individualization which heretofore has been illusive.

Computer-based education has roots both in behaviorism and in cognitive psychology. From the behaviorists comes the concept of reinforcement and especially the emphasis

upon highly reliable presentation of materials. From the cognitive psychologists come the concentration upon the nature of complex problem-solving behavior and the consideration of insight. Also, from the cognitive psychologist has come the idea of viewing the human nervous system as a data-processing and storing mechanism that relates new input to already existing information.

The review of research presented has been limited to those studies whose subjects were at least fourteen years of age and many were college students. The first part of the review was limited to the research involving CAI, PI and reading; the second involved those that were concerned with various student characteristics, in the belief that this population and these types of studies held the closest relationship to this research project.

In one area, that of attitude toward computer assisted instruction, there exists a degree of consistency in these studies. When questioned about their attitudes toward CAI, itself learners responded positively. In some instances they also responded more favorably to the subject matter taught through CAI as well. Drop-out rates for CAI users were reported by some researchers as less than expected when considering more conventional methods of instruction. These

favorable attitudes appear to endure. The ratings of long term users revealed increased awareness of problems incurred through computer use, i.e. breakdowns and delays, but showed little deterioration in the overall positive attitude. This tended to lessen the concern that positive attitudes might be primarily the result of a novelty experience. While attitude toward instructional mode is important, especially perhaps in some student populations where persistence is not high, the reader should consider that in the Blitz and Smith study, preference for an instructional mode did not necessarily result in greater achievement.

Regarding achievement gain, these authors reported that CAI has been found to be as effective as other instructional methods and in some cases more effective. The reader should note that consideration of the measurement instrument is an important aspect to these studies. Results are more noteworthy when the subject has been given CAI that relates to the curriculum and has been tested with an instrument that directly reflects the learning experience.

In those studies emphasizing student characteristics, personality and learning style variables were incorporated into the research plan. Use of the Myers-Briggs Type Indicator in the Hoffman and Waters study revealed greater completion rate by those CAI users who were identified as sensing

types and conversely the highest drop out rate was associated with those whose personality type was extravert, perceptive. The Learning Style Inventory was used in the Kevin and Liberty study with the expectation that those subjects favoring the abstract experimentation learning style would score higher using CAI. Results proved otherwise, those favoring concrete experimentation scored highest. The reader is reminded that these results are important to this study because results of these two measurement instruments are being used as data variables.

Of the studies discussed in the second part of the review, few have used the same measurement instrument or endeavored to study similar student characteristics. Therefore it is difficult to find any consistency among characteristics. Only two studies clearly identified as aptitude treatment interaction research could be found involving CAI. These merited attention because of their similarity to the research problem of this study.

CHAPTER THREE

Procedures of the Study

This study was designed to compare two modes of instruction for teaching Latin and Greek derivatives to conditionally enrolled university students. Ways in which student characteristics affect achievement and attitudes toward modes of instruction were important aspects of the research.

This chapter describes the procedures used for the investigation. It presents information concerning the location of the study, the population, the Transitional Service Program, treatment procedures, and the measurement instruments used. The experimental design of the study and analysis of data are delineated.

Location

This research project was undertaken at Drake University, a private, Midwestern institution situated in Des Moines, Iowa. About five thousand students enroll in the eight colleges and schools of the university. Because of the nature of this study and the population selected, the Reading and Study Skills Clinic on this campus provided the administrative setting for the study.

The Reading and Study Skills Clinic affords students the opportunity to improve the learning skills necessary for successful college work with credit-no credit options available. Its services include academic counseling and diagnostic testing. Providing both individual and group assistance, the clinic offers courses in college reading and study skills. Students, may, if they prefer, elect to work independently using a wide variety of content materials housed in the clinic.

Population

The eighty-three students of Drake University's fall, 1982 Transitional Services Program were the subjects for this investigation. This group of students had not met Drake's admission standards in reference to high school grades or ACT-SAT scores, but were "conditionally enrolled" pending successful completion of a special preparatory program.

Many of these students come from the Midwestern region and from middle to upper middle class backgrounds. A closer examination of this population as a group reveals differences related to the instructional environment. Their reading skills, as measured by standardized reading tests, frequently fall below average, varying by several percentiles. Very few students demonstrate a high proficiency in vocabulary skills.

Generally, the TSP students differ from other university students, not only in academic skills, but in motivation and self confidence as well. Some exhibit a great motivation for admission to the university, often accompanied by high levels of anxiety for academic success. On the other hand, there are those who lack such motivation and do not choose success in college as a top priority. These students often lack confidence both academically and personally in their ability to make decisions, but the manner in which they demonstrate this differs. Some will readily discuss their misgivings, while others retreat behind a shield of false bravado. Classroom observation of these students reveals a passive attitude toward learning. Active participation and student responsibility for learning are very difficult to facilitate. These general characteristics, together with the lack of vacabulary skills, provides the basis for this research.

Transitional Services Program

This preparatory program which began in 1969 is designed to help meet the needs of educationally underprepared students who show promise but have not met all the qualifications for admission to Drake University.

Providing a transition from high school academic standards to the more rigorous college level requirements appropriately defines this program's aim and purpose.

Students in the TSP program must attend, and successfully complete, a two hour course (ED 13) taught by graduate assistants and supervised by the director of the Reading and Study Skills Clinic. Lectures and exercises are presented to help students develop efficient reading and study skills. The course is developed around these topics: time management, reading for meaning, context vocabulary clues, study techniques, concentration, note-making techniques and test-taking strategies.

To be eligible for regular university admission TSP students must complete a minimum of ten hours of college course work which includes ED 13, Freshman English I (Composition), and two or three elective courses, and accumulate a 2.0 grade point average during their first semester. In the fall of 1982, the students were required to take Psychology I which reduced their electives to one or two classes. Student progress in the program is carefully monitored by the director of the study skills clinic, the graduate assistants, and the director of the Transitional Services Program through an academic counseling component designed to give immediate personal attention to concerns as they arise.

Text Selection

The purpose of this study was to compare the effects of a computer assisted instructional format with a programmed text format in teaching Latin and Greek derivatives to conditionally enrolled university students. An initial task involved the selection of a programmed vocabulary text. The second edition of Programed College Vocabulary 3600, written by George Feinstein, published by Prentice Hall (1979), was chosen for its content and presentation style. Permission was obtained from the publishers to convert portions of the text to CAI lessons as well as to make the modifications needed for this. See Appendix A for the permission letter.

While no major changes in the text were necessary, minor modifications had to be made to accommodate a computer presentation. Modifications mainly entailed assigning letters to correspond with answer choices. In this way students at the computer terminal typed only the letter representing their answer choice instead of the whole answer. Opportunities for typing errors were, thereby lessened. While both positive and negative reactions are connected with this decision, it was thought that attention should be focused on vocabulary as represented by the choice of answers and not on typing or writing skills.

Caldwell, who has conducted CAI research using both types of responses, has described these reactions. On the positive side, students seemed to improve spelling and writing skills, but there were also negative effects. Typing the response or answer became time-consuming and frustrating if many errors were made. In addition the computer counted these responses incorrect and if the student did not know how to correctly respond, he could be caught in a loop that would not allow him to advance.[1]

Computer System

The computer hardware system at Drake University is VAX/VMS (Version 3.1) with Mainframe DEC VAX-11/780. The languages available are: APL, Basic (VI.4), Fortran (V3.1), MACRO (V2.45), COBOL (V2.0), LISP, and PASCAL (VI.3). There are 75 terminals available for student use across campus. Eight are located in each of five sites with 35 housed in a business classroom used for class purposes at various times. The computer center provides consultants at these various locations to help students with any problems they may encounter; in addition the center maintains a general consulting campus telephone service that connects students with consultants at the center.

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[1] Robert Caldwell, "Designing Effective Computer Based Education to Teach Reading to Nonliterate Adults," Journal of Instructional Development, 3, No. 4 (Summer 1980), 23.

Interactive Examination Service

This project utilized one of Drake's computer programs called the Interactive Examination Service which allows a student to interact directly with the computer in a question and answer session resembling a paper and pencil test. This program, written in COBOL, required an information file in which the instructor places all information he or she wants readily accessible for student use. In this manner the identical information contained in the modified programmed text was entered into the computer program to become the CAI presentation.[1]

The program also requires a master file of users which contains each student's name and identification code. By using an editor, the researcher created this file of legal users so that only those students in the project could participate. This file served another function. It allowed the researcher to view each student's scores and progress through the lessons. By entering the student's name and identification code, his or her scores appeared on the screen in the form of a percentage of correct responses. If the student had not completed a particular lesson, a zero would

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[1] Kevin R. Storm, "Interactive Examination Service" (Drake Univ., 1982), 11 (Computer Printout).

appear on the screen for that lesson.

Since this Interactive Examination Service allows for variations in the way an instructor chooses to use it, the instructor must determine his/her set of instructions. Some of these options include the amount of time a student is given for the work, the number of allowable attempts to respond correctly and the possibility of skipping questions. In this project no time limit was set for completion of a lesson, but the student had to respond to any given question before ten minutes had elapsed. A question was repeated once if incorrectly answered on the first attempt. No questions could be skipped. This was intended so that each student had to respond to all items.

Because the program was modified slightly to fit the needs of this study, it was reviewed and tested by selected computer personnel and student consultants. At the end of this phase of testing, one student interested in independent vocabulary study used the CAI mode of presentation. It was then ready for use in this research.

Program Execution

When this CAI presentation is executed, the student is asked to enter the name of the instructor's information file. If this is done incorrectly, the student must repeat the

procedure. Then, the student is asked to enter his own identification code. If an error is made here, the student gets another opportunity to enter the code. If another error is made, the computer will notify the student that an invalid code has been entered and suggest calling the instructor. If the code is entered correctly, the program will continue and the student selects the lesson he wishes to view.

Each frame of the lesson contains a Latin or Greek root or prefix followed by the English meaning and several English derivatives. See Appendix C for an example. A question is then asked that is intended to reflect the student's understanding of the root, prefix or derivative. The choices of answers are displayed and the student responds with a letter to represent his choice. Immediate feedback is given. If correct, the student is notified and the next frame appears; if incorrect, the student is asked to read the frame and try again. After selecting his second answer, the student is always presented with the correct choice, giving him the opportunity to learn from any error he has made. At the end of the lesson, the student's total score is displayed.

Vocabulary Unit

Both Latin and Greek segments of the vocabulary unit contained fifty roots and prefixes equaling a total of one hundred. Each language contained ten lessons. After completing the Latin pretest, which was administered during a regular class session, students were given two weeks to complete this portion of the unit. Time management within these two weeks was an individual decision. At the end of the first two week session, or the Latin portion of the unit, students took the Latin achievement posttest and completed the semantic differential measuring attitude for the particular mode of instruction that they used. These were also administered during class. The same process was repeated for the Greek portion of the unit. The Greek pretest was administered, followed by two weeks for completion of the Greek segment of the unit and then the Greek posttest and the second semantic differential was given.

Procedures

Since all of the TSP students were targeted for participation, all three graduate assistants teaching the ED 13 classes participated. Each graduate assistant taught two sections of the course and administered the measurement instruments during regular class sessions. Each student

was given the Learning Styles Inventory, the Myers-Briggs Type Indicator, two vocabulary pretests, two achievement posttests, and two attitudinal scales. These scales consisted of the same semantic differential completed twice by each student: once in reference to the programmed text and then again regarding the CAI version. In addition each student was given the (SIT) Slosson Intelligence Test, an individualized intelligence test administered with the assistance of two other people: the director of the reading and study skills clinic, and a part-time reading instructor. Because of its individualized nature, this test required scheduling at times other than regular class sessions. Even though the SIT required less time to administer, each test took an average of thirty minutes to complete. The total population of 83 was as evenly divided as possible among the five test administrators. These people were thoroughly familiarized with the evaluation instruments and the procedures of the study prior to beginning the testing. The SIT, the Learning Styles Inventory, and the Myers-Briggs Type Indicator were administered before the treatments began.

Through the use of a set of randomized numbers obtained from the computer, the students were randomly assigned to the two treatment groups. The content of instruction was identical for these two groups; they differed only in sequence of mode. Treatment One learned the Latin roots and

prefixes by the programmed mode and the Greek portion of the unit by the computer mode. Treatment Two studied the Latin roots and prefixes by the computer mode and the Greek portion of the unit by the programmed mode.

By using a team teaching approach, students were introduced to the vocabulary unit during regular class time and given a demonstration of the procedures necessary for completion of the instructional unit. Those students assigned to Treatment One received instructions from their instructor for the programmed mode and were given the opportunity to begin work. The instructor remained available for guidance. At the same time, the researcher explained the instructions for using the computer mode to those students assigned to Treatment Two and demonstrated the procedures at the computer terminal. The researcher remained available for questions as the students in Treatment Two began lesson one at the computer terminal. After completing the Latin part of the unit, the students changed modes of instruction to study the Greek vocabulary. The demonstration and instructions for the two procedures were repeated.

Table I

Time and Event Table

Time	Event	Treatment One	Treatment Two
Sept. 27-Oct. 8	Slosson	X	X
Oct. 11 -Oct. 15	Myers-Briggs Type Indicator	X	X
	Learning Styles Inventory	X	X
	Latin Pretest	X	X
Oct. 18- Nov. 2	Directions and Demonstration For PT	X	
	For CAI		X
	Ten Latin Lessons	X	X
Nov. 4	Latin Posttest	X	X
	Semantic Diffential For PT	X	
	For CAI		X
Nov. 8 - Nov. 19	Greek Pretest	X	X
	Directions and Demonstration For PI		X
	For CAI	X	
	Ten Break Lessons	X	X
Nov. 23	Greek Posttest	X	X
	Semantic Diffential For PI		X
	For CAI	X	

Treatment One--Latin-Programmed: Greek-Computer

After completing the Latin pretest, the forty-one students comprising Treatment One studied the Latin lessons one through ten by using the programmed text. All work was done in the programmed instruction room of the Reading and Study Skills Clinic and was monitored by the instructors. Upon finishing the Latin lessons, a posttest was administered, as well as the semantic differential to measure their attitude toward using a programmed text.

After completing the Greek pretest, these students studied the Greek lessons one through ten by using the computer mode.

This was followed by a Greek posttest of the Greek roots and prefixes. The same semantic differential was used again to measure their attitude toward using a computer mode.

Treatment Two--Latin-Computer: Greek-Programmed

The forty-two subjects in this treatment studied Latin lessons one through ten by using the computer mode. They were familiarized with the locations of terminals across campus and encouraged to speak with consultants if they encountered problems. Upon finishing the Latin lessons, the posttest was administered, as well as the semantic differential to measure their attitude toward using the computer mode.

After completing the Greek pretest, these students studied the Greek lessons one through ten using the programmed mode. This was followed by the Greek posttest of the Greek roots and prefixes. They filled out the semantic differential this time by considering the programmed mode.

Instrumentation

Data were gathered using five measurement tools. These were the Slosson Intelligence Test, the Myers-Briggs Type Indicator, the Learning Styles Inventory a semantic differential and Latin and Greek achievement tests.

The Slosson Intelligence Test is a brief individual intelligence test that does not require professionally trained examiners and may be used with adults as well as children. All responses given by the subjects are oral.

The items of the Slosson Intelligence Test are similar to those found in the Stanford-Binet, Form L-M. It does have a higher ceiling and a lower base. A reliability coefficient of .97 was obtained on a test-retest procedure (2 month interval) for 139 people aged 4 to 50 years. The mean IQ for the first test was 99.0 and 101.3 for the retest. High correlations of concurrent validity was found for the SIT and Stanford-Binet, Form L-M. To avoid bias 141 subjects were independently tested. The author of the SIT administered it while the Stanford-Binet was administered by other qualified personnel. For these subjects, aged 4-19, a reliability coefficient of .92 was obtained. The mean for the SIT was 107.2 and for the Stanford-Binet it was 107.7. The standard deviation between SIT was 19.9 and 20.2 for the Stanford-Binet.[1]

This test was administered prior to the treatments so that it could be used as a control variable. Since this

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[1] Richard L. Slosson, Slosson Intelligence (SIT) for Children and Adults, 3d ed. (New York: Slosson Educational Publications, 1963), pp. iv-v.

study involved the measurement of vocabulary achievement, it was appropriate to designate intelligence as the control variable to avoid confounding the results of the investigation.[1] Vocabulary is regarded as an essential factor in intelligence at all ages.[2]

The Myers-Briggs Type Indicator was selected to measure personality characteristics. Analysis of these characteristics related to the research question: How will performance scores in each instructional mode relate to personality characteristics? This instrument is designed for grades 9-16 as well as adults and produces four scores: extraversion vs. introversion (EI), sensation vs. intuition (SN), thinking vs. feeling (TF), and judgments vs. perception (JP).

The EI index is intended to specify if a person is an extravert or introvert. An extravert focuses basically on people and things or the outer world. An introvert focuses basically upon concepts and ideas or the inner world.

The SN index is intended to specify whether a person mainly relies upon sensing, using one of the five senses to

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[1] James W. Popham and Kenneth A. Sirotnik, Educational Statistics Use and Interpretation, 2d ed. (New York: Harper & Row Publishers, 1973), p. 206.

[2] George D. Stoddard, The Meaning of Intelligence (New York: Macmillan Co., 1943), p. 111.

identify things or whether he/she mainly relies upon intuition, involving indirect perception through the unconscious focus on ideas or associates representing those things perceived.

The TF index is intended to specify if a person relies mainly upon thinking, calling for an impersonal discrimination between true or false or if he relies mainly upon feeling which designates valued or not-valued.

The JP index is intended to specify if the individual basically prefers to use judgment (T or F) or perception (S or N) to deal with the extraverted portion of his life of the outer world.[1]

The main purpose of this instrument is to determine basic preferences, reflecting a habitual choice between opposites. For example EI does not mean E and I but rather E or I. If a person has more points tallied for E--he or she is classified as extravert. The number is evidence of the strength or preference. All four scores contribute a letter, for example, ISTJ, which indicates a personality type.[2]

Split-half reliability has been obtained of the indices of various grades through the use of the Spearman-Brown prophecy formula. While great diversity was reflected in

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[1] Isabel Briggs Myers, The Myers-Briggs Type Indicator (Princeton, N.J.: Educational Testing Service, 1962), pp. 1-2.

[2] Ibid., pp. 2-3.

age, socio-economic status and intellectual ability, the coefficients did not fall below .75 except for non-prep 12th grade and 8th grade underachievers. These scores represent the upper range of coefficients for self-report instruments of comparable length.[1] The median reliability coefficient on the various scales has been near .70, with the low sometimes falling below .50, and the high going above .80.[2]

Since the reliability coefficients of this test were found to be in the upper range for self-report instruments and the TSP students did not represent non-prep 12th graders or 8th grade underachievers, this inventory was judged as suitable for this population.

Considerable data was collected in the validation of this test. Sources included turnover in several kinds of employment, grades, and evidence of academic achievement, scores from other personality inventories, creative achievement and teacher ratings of students. These reveal significant relationships. For example, a majority of highly creative individuals were found to be mainly intuitive and this relationship was not affected by sex or occupational field. Evidence was found that introversion, intuition, and

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[1] Ibid., p. 20.

[2] Frank S. Freeman, Theory and Practice of Psychological Testing, 3d ed. (New York: Holt, Rinehart & Winston, 1962), p. 604.

judgmental attitude were associated with high academic achievement.[1]

The Learning Styles Inventory was selected to distinguish among learning styles and provide a data base for investigating the research question: How will performance scores using each mode of instruction relate to learning styles?

Pask argued that students should obtain an awareness of their learning style because they frequently enter college with little understanding of what is expected of them. Realizing that there are different styles of learning may help them determine an appropriate approach to studying.[2]

This measurement instrument is a nine-item self-description questionnaire that yields a comparison of active experimentation to reflective observation and a comparison of concrete experience to abstract conceptualization.

To score high on Concrete Experience indicates an approach to learning based upon experience, feelings and a tendency to be receptive. Persons with high CE scores tend to be people oriented but this orientation favors peers more than authority through discussion and feedback from fellow learners.

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[1] Anne Anastasi, Psychological Testing, 3d ed. (London: The Macmillan Co. - Collier Macmillan Limited, 1968), p. 455.

[2] Noel Entwistle, Styles of Learning and Teaching (New York: John Wiley & Sons, 1981), p. 215.

They seem to learn by specific examples which allow them to become involved.

A high score on Abstract Conceptualization represents a reliance upon logical thinking, an analytical approach that leads to rational evaluation. Persons with high AC scores have a tendency to be less orientated toward people than they are toward things and symbols. While they can be frustrated by unstructured learning situations such as simulations, they are comfortable with direction and impersonal learning settings consisting of systematic analysis and theory.

To score high on Active Experimentation indicates an orientation to learning that includes activity and experimentation. While projects and small group discussions will appeal to these learners, lectures or other passive learning settings will not. Extraversion is a characteristic of individuals who score high in this category.

A high score on Reflective Observation represents a reflective impartial approach to learning that emphasizes careful observation. Lectures provide a comfortable setting for these individuals because they may assume a passive observant role. A high score in this category reflects introversion characteristics.[1]

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[1] David A. Kolb, Learning Styles Inventory Self-scoring Test and Interpretation Booklet (Boston, Massachusetts: McBer & Co., 1976), p. 5.

Split-half reliability computed for the two combination scores AE--RO yielded .80 coefficients. This is comparable to many psychological self-report measurements.[1]

Correlations have been made between the Learning Styles Inventory and the Myers-Briggs Type Indicator. It was thought individuals who scored high on Abstract Conceptualization should tend to use thinking for a judging mode and intuition for a perceiving mode. Those scoring high on Concrete Experience should tend to use feeling for a judging mode and sensation for a perceiving mode. Reflective Observers, those favoring the intuitive perceiving mode, would be introverts, while Active Experimenters, those favoring the sensation perceiving mode, would be extraverts. The data tended to support these hypotheses but not consistently over all groups. The groups consisted of 74 University of Wisconsin MBA's, 135 Kent State undergraduates, and 46 educational administrators. The hypothesis appeared to be supported regarding the Kent State group, a group which shares some characteristics with the TSP group used in this study.[2]

A semantic differential was used to measure attitude toward the modes of instruction. Specifically, it was intended to provide data concerning the research question:

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[1] Ibid., p. 14.

[2] Ibid., p. 29.

How will performance in each instructional mode relate to attitude toward the modes of instruction?

Osgood, Suci and Tannenbaum described the instrument and documented its effectiveness. The semantic differential is basically a combination of scaling procedures and controlled association. The subject is provided with a concept to be differentiated through a set of bipolar adjectives. He indicates the direction and intensity of his association on a seven-step scale.[1] This is a twenty-five item scale that presents a concept and requires that the individual react by checking one of seven points between two polarities such as REWARDING--DISCOURAGING.

These authors described the format of the instrument in this manner:

> These digits may be either 1, 2, 3, 4, 5, 6, and 7 or +3, +2, +1, 0, -1, -2, -3. For most of the mathematical treatments to be described, the choice here makes no difference; the set from +3 to -3 has the heuristic advantage of fixing a point of an origin in the center of the semantic space, which corresponds to the neutral "4" position on the scales, as well as reflecting the bipolar nature of the scales we use. A person's score on an item is the digit corresponding to the scale position he checks...[2]

The specific scale used in this research was identical to that used by Mull and Caldwell in their dissertation

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[1] Charles E. Osgood, George J. Succi, and Percy H. Tannenbaum, The Measurement of Meaning (Urbana: Univ. of Illinois Press, 1957), p. 20.

[2] Ibid., p. 86.

studies, and was designed by Peters and Rookey.[1] On the seven-point scale, 1 represented an extremely negative attitude, while 7 represented the most positive reaction.

In order to provide a measurement of achievement, two fifty item pretests were given: one contained Latin derivatives and the other contained Greek derivatives. These criterion referenced tests were followed after treatment by two fifty item posttests that were used to assess gain in these two parts of the vocabulary unit.

These criterion referenced tests were selected rather than standardized reading tests because they more specifically measured the achievement results of the instructional treatments. Shaycoft illustrated this rationale:

> scores are interpreted as having some set of absolute meaning in terms, for instance of level of performance or amount achieved or degree of mastery; in other words, the criterion-referenced score has some sort of meaning in itself, irrespective of the scores for specified groups.[2]

Tyler and Wolf indicated that two functions are served by the criterion referenced approach. First, it focuses attention on the main purpose of instruction-the behavior and performance of the student. Second, it focuses reward

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[1] Caldwell, p. 54.

[2] Marion F. Shaycoft, Handbook of Criterion-referenced Testing; Development, Evaluation, and Use (New York: Garland STPM Press, 1979), p. 3.

upon the student's achievement of the criterion and not upon the performance of his peers.[1]

One criterion was identified for this vocabulary unit: On a paper-and-pencil test of fifty items, the student will identify the proper choice of answer to complete the sentence with at least 70% accuracy.

Experimental Design

The design selected for this study was the 2 X 2 factorial design discussed by Isaac.[2]

It was necessary to use this design since the research involved two treatment modes and contained two parts, Latin and Greek. An achievement score was derived for Latin as well as for Greek. The design used gave each student the opportunity to use both instructional modes, PI and CAI. Much of the past research has been conducted by having one group use one mode while a second group uses another mode. In the present study, a comparison could be made of each student's two achievement scores, one representing achievement through use of CAI and the other representing achieve-

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[1] Ralph W. Tyler and Richard M. Wolf, eds., Crucial Issues in Testing (Berkeley, Calif.: McCutchan Publishing Corporation, 1974), p. 86.

[2] Stephen Isaac and William B. Michael, Handbook in Research and Evaluation (San Diego, Calif.: Robert R. Knapp 1971), pp. 50-51.

ement through use of PI, and the student's opinion of both modes of instruction.

In his discussion of factorial designs, Isaac stated that research involving complex behavior may be well-suited for these designs because it allows more than one factor to vary at a time. Differences caused by the interaction of factors could go unrecognized if these factors are considered singularly.[1]

He described four advantages of using these designs rather than the classical experimental design:

> 1. They permit the testing of several hypotheses simultaneously, rather than having to conduct a series of single X experiements to study the effects of different X's on, for example, learning.
>
> 2. They permit the conduct of only one experiment to answer several complex questions at once, such as: What effect does X-type teacher have on learning achievement when using X-type methods in X-length classes with X-type students?
>
> 3. Where interaction between two or more variables simultaneously make a difference, it reveals this difference.

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[1] Ibid., p. 50.

4. Where the classical experimental control of all variables but one is impractical or impossible.[1]

Data Analysis

The data analysis for this project was obtained through the use of the Statistical Package for the Social Sciences (SPSS), a series of programs providing a variety of descriptive and inferential statistics useful in data analysis in the social sciences. All analysis employ a standard set of program statements executed by natural-language.[2] The independent variables in this study consisted of: eight personality factors, four learning style factors, attitude to computer, attitude toward programmed text, subject (Latin or Greek), sequence (PT-CAI of CAI-PT), and mode (CAI or PT). Scores from the Slosson Intelligence Test were designated as the covariate. Two dependent variables were established: Latin and Greek posttest scores.

Two ANOVA's and one t-test were computed on pretests, posttests, and attitude toward both modes of instruction. From these analyses a comparison of Latin pretest scores with Greek pretest scores was made. Attitude toward both modes of instruction was investigated for indications of

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[1] Ibid.

[2] George W. Miller, "SPSS on the VAX" (Drake Univ.,1983), 1 (Computer Printout).

preference for CAI as compared to PT.

Two multiple classification ANCOVA's were conducted. The first examined posttest scores by subject and mode of instruction. In this way, the effect of subject upon mode was investigated. The second ANCOVA examined posttest scores by subject and sequence (CAI--PT and PT--CAI). This procedure was used to designate any effect that sequence of mode might have on subject.

Eight single classification ANOVA's were computed. In two of these the posttest was used as the dependent variable and in the other six, attitude toward mode of instruction was used. With the posttest being used as the dependent variable, the first single classification ANOVA examined the four personality types to see if students of any type achieved more than the others. The second ANOVA operated in the same way, but used the four learning styles as the independent variable. Six single classification ANOVA's were conducted on attitude toward CAI, attitude toward PT and attitude difference on both the personality types and learning styles.

CHAPTER FOUR

Presentation of Date Analysis

Purpose of The Study

The purpose of this study was to compare two modes of instruction for teaching Latin and Greek derivatives to conditionally enrolled university students. Student characteristics, specifically pertaining to learning styles and personality were designated as particularly important in this research and were examined in relationship to both achievement and attitude toward mode of instruction.

Population

The eighty-three students at Drake University's fall, 1982 Transitional Services Program were selected as the subjects for this investigation. Students were randomly assigned to the two treatment groups. Both groups completed the Latin and the Greek portion of the instruction and each student was given the opportunity to use both modes of instruction, CAI and PT. All participants received the same sequence of instruction: the Latin lessons came first, followed by the Greek part of the vocabulary unit. In only one way did the treatments vary-the sequence of mode. One group followed sequence one (PT--CAI), while the other completed the vocabulary unit in sequence two (CAI--PT).

Twelve students were dropped from the study because of missing data: nine did not complete the instruction during the time limits, two dropped out of school and one failed to finish because of illness. Complete data was tabulated for 71 participants. Treatment One comprised 36 subjects, while Treatment Two contained 35.

Null Hypotheses

1. There will be no difference in the Latin and Greek achievement scores.
2. After controlling for intelligence, there will be no interactive effect between subject and mode of instruction.
3. After controlling for intelligence, there will be no difference in achievement scores of the computer assisted instructional mode as compared to the programmed mode.
4. Attitude toward the computer assisted mode will not be more positive than attitude toward the programmed mode.

Instrumentation

To investigate the research questions, data was collected from six measurement instruments: the Slosson Intelligence Test, the Myers-Briggs Type Indicator, the Learning Styles Inventory, a semantic differential and Latin and Greek pre-posttests. The SIT, semantic differential and Latin and Greek pre-posttests each yielded a single score

that became a variable in the study. The intelligence quotient, derived from the SIT, was used as a covariate or a control variable.

The Myers-Briggs Type Indicator yielded eight scores that were combined to describe four personality types or variables. Personality 1 distinguished the "Thoughtful Realist." Some combination of I or Introverted and S or Sensing contributed to this designation. People of this personality type tend to be quiet, observant and interested in getting the facts. Knowledge as it relates to establishing truth is important and they are guided by inner principles. They enjoy seeking the depth of things but prefer that they be practical. A general population could expect to have 24% of its members representing Personality 1. Personality 2 designated the "Thoughtful Innovators." A combination of I of Introverted and N or Intuitive produces this classification. These people tend to be quiet, interested in knowledge for its own sake and new ideas. Practicality is not as important to these people as in other personality types and they are inclined to be future-oriented. Only 4% of the general population represent this type. Personality 3 represented the "Action-Oriented Realists." This type reflected some combination of E or Extraverted and S or Sensing. These individuals value the sociability offered by groups and the ideas and opinions of others. They

are interested in facts and details, particality and can generally be depended on to get the job done. They do not, however, like to sit still for long periods of time. Most people (52%) appear to be characterized by the qualities associated with this personality group. Personality 4 designated the "Action-Oriented Innovators." A combination of E or Extraverted and N or Intuitive produced this fourth type. These individuals are not so interested in practicality as they are in new ideas. Knowledge as it is associated with new possibilities is important. Their need for enthusiasm in searching out these new possibilities can lead to overcommitment, but routine work produces the opposite effect and can lead to ineffectiveness. Action-Oriented Innovators represent 20% of the population.[1]

The Learning Styles Inventory produced four scores that described four learning styles or variables. Learning Style 1 designated the "Converger" whose learning abilities reflect a greater degree of Abstract Conceptualization (AC) and Active Experimentation (AE) than in other learning styles. People of this type prefer dealing with things instead of people and exhibit technical interests. Practical application of ideas is important as well as situations that call for a single correct answer or solution. A combination of

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[1] Myers, A5-8.

Concrete Experience (CE) and Reflective Observation (RO) designated Learning Style 2 or the "Diverger." These individuals tend to have learning abilities that are opposite to the converger or Learning Style I. Divergers are more interested in sociability and tend to be emotional, and imaginative. They are interested in generating ideas from examining a concrete situation from many perspectives. Learning Style 3 designated the "Assimilator" or those whose scores reflected a high degree of Abstract Conceptualization (AC) and Reflective Observation (RO). Inductive reasoning characterizes this style as well as a high regard for creating theoretical models. These people are less concerned with facts than abstract concepts and tend to be less social than the diverger. Learning Style 4 characterized the "Accommodator." A combination of Concrete Experience (CE) and Active Experimentation (AE) created a style opposite that of the Assimilator or Learning Style 3. These individuals favor activity in new experiences and are not opposed to risk-taking. Facts are important as well as solving problems through an intuitive trial and error process, however, they tend to rely upon other people's information rather than their own analysis. While Accommodators are sometimes viewed as impatient, they generally reflect an ease with

people.[1]

A semantic differential was administered twice to determine attitude toward both modes of instruction. A copy of this scale is included in Appendix B.

Experimental Design

A 2 X 2 fixed effects factorial design was employed to analyze the data. This design gave each student the opportunity to complete both Latin and Greek vocabulary units by using both modes of instruction, CAI and PT. Because of this design a comparison was made of each student's achievement scores, one representing achievement through use of CAI and the other representing achievement through the use of PT. Students' opinion of both modes of instruction could be analyzed in the same manner.

Results

Achievement

The following data analysis was made utilizing complete data from 71 participants in the study. The subjects were further categorized into two treatment groups: 36 were assigned to Treatment One and 35 were placed in Treatment Two. Because each subject completed both parts of the instruction, N or number is 142.

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[1] Kolb, p. 7

Table 2

Description of Subpopulations

	Latin			Greek		
	N PT	N CAI	TOTAL	N PT	N CAI	TOTAL
Treatment One	36				36	
Treatment Two		35		35		
Total			71			71

An ANOVA is presented in Table 3 for the pretest by subject: subject 1 represents the Latin unit and subject 2 represents the Greek. There is no significant difference in pretest scores for either Latin or Greek. The mean score on the Latin test is 30 and the mean score on the Greek test is 29. Students did not show greater prior knowledge of one subject than they did of the other.

Table 3

Analysis of Variance of Latin and Greek Pretests

Source of Variation	DF	S.S.	M.S.	F-Test
Between Subjects	1	38.563	38.563	NS
Within Group	140	3959.634	28.283	

Another ANOVA is presented in Table 4 for the posttest by Latin and Greek. There is no significant difference in the posttest scores in either subject. The mean score for both subjects is 40. Students did not show greater achievement in either subject, therefore Null Hypothesis 1 is not rejected. Because this mean score is obtained by students using both modes of instruction, Null Hypothesis 1 is not rejected.

Table 4

Analysis of Variance of Latin and Greek Posttests

Source of Variation	DF	S.S.	M.S.	F-Test
Between Subjects	1	10.169	10.169	NS
Within Group	140	5759.775	41.141	

Table 5 shows the results of the Latin and Greek posttests scores in reference to the single criterion designated for this study. That criterion was established as: On a paper-and-pencil test of fifty items, the student will identify the proper choice of answer to complete the sentence with at least 70 percent accuracy.

Table 5

Number of Students Reaching Criterion Mastery on Pretests and Posttests

	Latin		Greek	
	N Pre	N Post	N Pre	N Post
Criterion Levels in Percent				
90-100	0	23	0	24
80-89	1	22	3	20
70-79	18	15	10	12
60-69	23	7	22	7
50-59	19	4	24	7
49 and Below	10		10	1

On both the Latin and the Greek posttest the highest category (90-100) contained the greatest number of student scores. For the Latin test this was 23; for the Greek it was 24. There were those who did not reach the criterion of 70 percent, however. On the Latin test 11 students or 15 percent of the population scored below the criterion; on the Greek there were 14 students or 20 percent.

Results of the two 2 x 2 factorial ANCOVA's appear in Tables 6 and 7. Posttest scores were used instead of gain scores because a partial correlation revealed a negative correlation between gain scores and pretest scores. Pre test scores were high and in some cases did not allow for much gain. As the score on the pretest increased, the amount of gain decreased. For this reason, and because the subjects were randomly assigned to the treatment groups showing no significant differences on the pretest, the posttest scores were used as the dependent variable.

Table 6 contains the analysis of subject and mode on the posttest. After controlling for intelligence, there was no interaction between subject and mode, and no main effects. There was also no difference in achievement scores of the computer assisted instructional mode as compared to the programmed text mode. Students scored as well on the Latin as on the Greek unit and as well with CAI as with PT. Therefore, Null Hypothesis 2 and 3 are not rejected.

Table 6

2 X 2 ANCOVA: Analysis of Subject and Mode on Posttest

Source of Variation	DF	S.S.	M.S.	F-Test
Covariate-Slosson	1	1259.877	1259.877	
Subject	1	10.277	10.277	NS
Mode	1	1.488	1.488	NS
Subject X Mode	1	19.686	19.686	NS
Residual	137	4478.723	32.691	

Although not directly related to the investigation of a research question, the results of another ANCOVA are included. Table 7 contains the anaylsis of subject and sequence of instructional mode on the posttest. Because subjects in Treatment One did the programmed version first followed by the CAI version, while Treatment Two used CAI first and then PT, an additional question resulted. Did the sequence of either treatment group have an effect on posttest score? As can be seen in Table 7 there was no interaction between subject and sequence of instructional mode and no main effects. These results indicated no significant differences in posttest achievement attributed to sequence.

Table 7

2 X 2 ANCOVA: Analysis of Subject and Sequence on Posttest

Source of Variation	DF	S.S.	M.S.	F-test
Covariate-Slosson	1	1259.877	1259.877	
Subject	1	10.169	10.169	NS
Sequence	1	19.686	19.686	NS
Subject X Sequence	1	1.488	1.488	NS
Residual	137	4478.723	32.691	

Because of the emphasis on individual characteristics and their relationship to both achievement and attitude, descriptive statistics are presented in Table 8 for personality type and Table 10 for learning styles on the posttest. In addition, two single classification ANOVA's were computed. The first, appearing in Table 9, contains the analysis of four personality types on the Latin posttest. The second ANOVA, referred to in Table 11, contains the analysis of learning styles on the Latin posttest. Because there were no significant differences in the means of the two treatment groups on either the Greek or Latin posttest, this analysis was not repeated for the Greek posttest.

Table 8

Descriptive Statistics of Personality Types on Latin and Greek Posttests

Personality Type	N	Latin Mean	Latin S.D.	Greek Mean	Greek S.D.
Per 1	13	41.385	6.653	41.769	4.764
Per 2	12	41.083	4.833	42.750	5.362
Per 3	32	39.187	6.428	37.219	8.127
Per 4	14	41.857	3.59	41.857	5.187

The results of the ANOVA involving personality type revealed no significant differences for main effects by personality type. Personality type 3 contained the greatest N, representing 46 percent of the total population. This group had the lowest mean score of the four groups, but it was not a significant difference. No significant differences appeared involving personality type and the posttest.

Table 9

1 X 4 ANOVA: Analysis of Personality Type on Posttest

Source of Variation	DF	S.S.	M.S.	F-test
Per	3	94.882	31.627	NS
Residual	67	2252.583	33.621	

Table 10

Descriptive Statistics on Learning Styles on Latin and Greek Posttests

Learning Style	N	Latin Mean	S.D.	Greek Mean	S.D.
Lrs 1	18	40.00	4.777	40.50	6.392
Lrs 2	18	40.278	4.496	40.333	6.463
Lrs 3	12	41.750	6.122	39.917	6.708
Lrs 4	23	40.217	7.317	39.087	8.224

The results of the ANOVA involving learning styles revealed no significant differences for main effects. Learning style 3 contained the fewest N (12) and the greatest N (23) was found in Learning style 4. While the population was about evenly distributed among these types, no type contributed to a greater performance on the posttest. No significant differences appeared between the learning styles and the posttest.

Table 11

1 X 4 ANOVA: Analysis of Learning Style on Posttest

Source of Variation	DF	S.S.	M.S.	F-Test
Per	3	25.691	8.564	NS
Residual	67	2321.774	34.653	

Attitude

A t-test is presented in Table 12 to analyze attitude toward both modes of instruction. A significant difference beyond the .01 level is revealed. Students showed a more favorable attitude toward CAI than PT. Therefore, Null Hypothesis 4 is rejected.

Table 12

t-test of Attitude toward CAI and Attitude toward PT

Attitude	Mean	S.D.	DF	t-value
CAI	136.789	23.874	141	8.70**
PT	117.789	23.248		

** @ > .01

Because of the emphasis on individual characteristics and their relationship to both achievement and attitude, six single classification ANOVA's revealing attitude were analyzed. Table 13 shows descriptive statistics on Personality Types and Table 17 presents these statistics on Learning Styles for Attitude toward CAI, and Attitude toward PT.

Table 13

Descriptive Statistics on Personality Types and Learning Styles for Attitude toward CAI and Attitude toward PT

Personality Type	N	ATTCAI Mean	S.D.	ATTPROG Mean	S.D.
Per 1	13	145.077	11.536	116.538	24.144
Per 2	12	126.583	33.625	115.833	20.467
Per 3	32	139.156	21.556	121.813	24.712
Per 4	14	132.429	26.538	111.429	22.218

Table 14, 15, and 16 presents the analysis of personality types on attitude toward PT, attitude toward CAI, and attitude difference. There were no main effects for personality type in any of these three analysis. No significant differences were revealed. Students in the four personality groups did not differ in their attitude toward PT, attitude toward CAI, or attitude difference.

Table 14

1 X 4 ANOVA: Analysis of Personality Type on Attitude toward PT

Source of Variation	DF	S.S.	M.S.	F-Test
Per	3	1150.630	383.543	NS
Residual	67	36951.199	551.510	

Table 15

1 X 4 ANOVA: Analysis of Personality Type on Attitude toward CAI

Source of Variation	DF	S.S.	M.S.	F-Test
Per	3	2588.344	862.781	NS
Residual	67	37593.488	561.097	

Table 16

1 X 4 ANOVA: Analysis of Personality Type on Attitude Difference

Source of Variation	DF	S.S.	M.S.	F-Test
Per	3	2143.300	714.433	NS
Residual	67	45550.707	679.861	

Attitude difference is computed in Table 16 according to personality type. Since all participants completed both instructional modes and an attitude score was obtained for each mode, the difference in these two scores could be analyzed with personality type. No significant differences were found. Students in the four personality groups did not significantly vary in attitude difference.

Table 17

Descriptive Statistics of Learning Styles on Latin and Greek Posttests

Learning Style	N	Latin Mean	S.D.	Greek Mean	S.D.
Lrs 1	18	147.667	19.569	129.889	19.721
Lrs 2	18	133.000	21.981	117.222	25.845
Lrs 3	12	139.917	22.105	114.750	21.029
Lrs 4	23	129.609	27.296	110.348	22.609

Tables 18, 19, and 20 presents the analysis of learning style on attitude toward PT, attitude toward CAI and attitude difference. There were no main effects of learning styles in any of these three analysis. No significant differences were found. Students in the four learning styles did not vary significantly in attitude toward PT, attitude toward CAI, or attitude difference.

Table 18

1 X 4 ANOVA: Analysis of Learning Style on Attitude toward PT

Source of Variation	DF	S.S.	M.S.	F-Test
Lrs	3	4025.474	1341.825	NS
Residual	67	34076.355	508.602	

Table 19

1 X 4 ANOVA: Analysis of Learning Style on Attitude toward CAI

Source of Variation	DF	S.S.	M.S.	F-test
Lrs.	3	3691.436	1230.479	NS
Residual	67	36490.395	544.633	

Table 20

1 X 4 ANOVA: Analysis of Learning Style on Attitude Difference

Source of Variation	DF	S.S.	M.S.	F-Test
Lrs	3	671.676	223.892	NS
Residual	67	47022.332	701.826	

CHAPTER FIVE

Discussion, Conclusions, and Recommendations

The Problem

The research was designed to compare a computer assisted instruction mode with a programmed text mode for teaching Latin and Greek derivatives to conditionally enrolled university students. Particularly important to the investigation were student characterisitics relating to personality types and learning styles. These characterisitics were examined in relationship to both achievement and attitude toward mode of instruction. The following question provided focus for this study: Will the use of a computer assisted instructional presentation result in a difference in student achievement and attitude when compared to a programmed mode of identical content?

Discussion

The data reveal no differences in achievement between the two treatments. Subjects using both CAI and PT did not achieve higher posttest scores in either mode. There was a significant difference beyond the .01 level in attitude toward CAI. While students favored CAI, their attitude did not result in significantly greater achievement. Analyzing differences in learning style and person-

ality types did not reveal differences in either achievement or attitude. Students achieved despite differences in personality and learning styles.

Two considerations are important to these findings. The first involves the student performance criterion established as 70 percent accuracy on posttests. While the highest category of posttest scores were found in the 90-100 percent level, 15 percent or eleven students on the Latin posttest and 20 percent or fifteen students on the Greek posttest did not reach this criterion level. There were ten students who scored below the 49 percent level on both the Latin and Greek pretests. Posttests scores show improvement, but they also indicate that the educational strategies of this vocabulary unit did not meet the needs of all students.

A second consideration that might provide a possible explanation for these findings if that of course completion. Because of their conditional enrollment, the subjects of this study did not have the viable option of dropping the course. Participation in this vocabulary unit which required both CAI and PT was necessary for satisfactory completion of the course, and acceptance of these students into the university depended in part upon fulfilling this requirement.

Conclusions

Two conclusions can be made from this research.

1. CAI is at least as effective as PT for teaching Latin and Greek derivatives. Some students, however, might have benefitted from additional vocabulary drill and practice in order to have met the mastery level. This tends to support Mitzel's recommendation for making a greater variety of learning strategies accessible to the learner.[1] Subjects were given two opportunities to learn the derivative after which they were presented with the proper choice of response. For some learners this may not have been sufficient for understanding. This tends to support Mitzel's claim that the current concepts of individualization are not sufficient to meet the needs of all learners. Specifically, this refers to the concept of linear progress and beginning at the proper point for each student.[2] This vocabulary unit required each student to begin at the same point.

2. When both instructional modes are available, student attitude should be considered in planning learning strategies. These findings indicate that both modes of

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[1] Mitzel, "On the Importance of Theory in Applying Technology to Education," p. 95.

[2] Ibid., p. 94

instruction should be considered as possible learning strategies for these students. This tends to support Mitzel's statement that student opinion should not be the only consideration.[1]

It was not the intent of this research to find a best mode of instruction, but rather to investigate the effectiveness of both modes. Even though there were no significant differences in either attitude or achievement among the personality types, it should be recognized that those students who show extraverted tendencies should have the opportunity to interact with other students and the instructor. The use of various kinds of automation within a course structure to carry out some educational functions, but not all, will allow for greater interactive opportunities.

Glenn Snelbecker makes a similar statement in the following manner:

> there is a growing acceptance of the belief that there may be many good teaching methods instead of only one. There is greater emphasis on finding the strengths and weaknesses of particular teaching methods. There is support for the belief that we should examine each teaching method to identify

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[1] Ibid.

> the educational experiences they make available for students and the kinds of educational objectives for which they seem to be most appropriate. In this context, it would seem appropriate to consider the kinds of teaching-learning opportunities which can be made available via computers and other electric devices.[1]

Recommendations

1. Further research should be conducted with these modes of instruction, specifically regarding the use of an audio component to enhance the learning strategies. The relationship between visual and audio media could provide additional information concerning the effectiveness of electronic devices.
2. Additional investigation of personality types and learning styles as they relate to learners and various educational experiences should be continued.

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[1] Glenn E. Snelbecker, "Impact of Computers and Electronic Technology on the Teaching Methodologies and the Learning Process," Journal of Children in Contemporary Society, 14, No. 1 (Fall 1981), 45.

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APPENDICES

APPENDIX A

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APPENDIX B

COMPUTER ASSISTED INSTRUCTION

For each pair of words below, place an "X" in the position between 1 and 7 that best fits your impression about computer assisted instruction.

	1	2	3	4	5	6	7	
exciting	( )	( )	( )	( )	( )	( )	( )	dull
alive	( )	( )	( )	( )	( )	( )	( )	lifeless
interesting	( )	( )	( )	( )	( )	( )	( )	boring
dread	( )	( )	( )	( )	( )	( )	( )	enjoy
dislike	( )	( )	( )	( )	( )	( )	( )	like
unnecessary	( )	( )	( )	( )	( )	( )	( )	necessary
easy	( )	( )	( )	( )	( )	( )	( )	hard
meaningful	( )	( )	( )	( )	( )	( )	( )	meaningless
unimportant	( )	( )	( )	( )	( )	( )	( )	important
successful	( )	( )	( )	( )	( )	( )	( )	unsuccessful
rewarding	( )	( )	( )	( )	( )	( )	( )	discouraging
valuable	( )	( )	( )	( )	( )	( )	( )	worthless
unfair	( )	( )	( )	( )	( )	( )	( )	fair
impractical	( )	( )	( )	( )	( )	( )	( )	practical
exact	( )	( )	( )	( )	( )	( )	( )	inexact
uncertain	( )	( )	( )	( )	( )	( )	( )	certain
organized	( )	( )	( )	( )	( )	( )	( )	disorganized
effective	( )	( )	( )	( )	( )	( )	( )	ineffective
good	( )	( )	( )	( )	( )	( )	( )	bad
relaxing	( )	( )	( )	( )	( )	( )	( )	tiring
harmful	( )	( )	( )	( )	( )	( )	( )	helpful
fast	( )	( )	( )	( )	( )	( )	( )	slow
flexible	( )	( )	( )	( )	( )	( )	( )	inflexible
informative	( )	( )	( )	( )	( )	( )	( )	uninformative
old	( )	( )	( )	( )	( )	( )	( )	new

APPENDIX C

SAMPLE VOCABULARY FRAMES

1. AM, AMAT: LOVE.
DERIVATIVES: AMATEUR, AMATIVE, AMATORY, AMIABLE, AMITY, AMORIST, AMOURS.

Since AMAT means LOVE, an AMATIVE young man is _____.

A. hostile
B. loving

2. AM, AMAT: LOVE.
DERIVATIVES: AMATEUR, AMATIVE, AMATORY, AMIABLE, AMITY, AMORIST, AMOURS.

The two letters in the words AMORIST and AMATORY that suggest LOVE are _____.

A. MO
B. OR
C. AM

3. AM, AMAT: LOVE,
DERIVATIVES: AMATEUR, AMATIVE, AMATORY, AMIABLE, AMITY, AMORIST, AMOURS.

The Casanova devoted to LOVE-making is an AMORIST and he has _____adventures.

A. amatory
B. mandatory

4. AM, AMAT: LOVE,
DERIVATIVES: AMATEUR, AMATIVE, AMATORY, AMIABLE, AMITY AMORIST, AMOURS.

Cleopatra's LOVE affairs are her _____.

A. altercations
B. amours
C. benefits

5. AM, AMAT: LOVE.
DERIVATIVES: AMATEUR, AMATIVE, AMATORY, AMIABLE, AMITY AMORIST, AMOURS.

Warm friendships between nations is international ____

A. animosity
B. amity